

Developing a Writer's Toolkit for Interactive Locative Storytelling

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Abstract. Despite the increasing popularity of locative interactive stories their poetics are poorly understood, meaning that there is little advice or support for locative authors, and few frameworks for critical analysis. The StoryPlaces project has spent two years working with over sixty authors creating locative stories. Through analyzing the stories themselves, and interviewing readers, we have developed a simple writer's toolkit that highlights the challenges and opportunities offered by locative fiction. In this paper we describe our approach, and outline twelve key pragmatic and aesthetic considerations that we have derived from our experience and analyses. Together these reveal that the main challenge in locative literature lies in aligning the narrative text, the structural logic, and the demands and affordances of the landscape.

Keywords: locative literature, interactive narratives, authoring

1 Introduction

Locative Stories are narratives read on mobile devices, where the reader interacts with the story by physically moving between locations. They were initially used for applications such as tour guides [5], but in recent years there has been a focus on interactive fiction [8], and the incorporation of new technologies (such as augmented reality [19]). Despite this interest there has been relatively little work on the poetics of locative stories - how they function to produce an effect in the reader. Such a poetics is needed to understand how authors can use the landscape to help tell their story.

StoryPlaces is a research project to develop these poetics, by working with writers in a number of different *Story Projects*. We have then analyzed their stories to understand the sorts of structures and methods they use [10], and have interviewed readers to understand how the interaction between narrative and landscape effected their experience. We have also developed our own location-based story using co-operative inquiry, and have used this experience to reflect on the decisions taken during the authoring process [16].

In this paper we draw on our story analyses and reader interviews from the first two Story Projects (Southampton and Bournemouth), and our co-operative inquiry to present an authoring toolkit in the shape of twelve pragmatic and aesthetic recommendations to authors. We have used this toolkit with our third story project (Crystal Palace Park), and present here one of these stories as a case study to show how those recommendations can be used in practice. Our hope is that they will help authors directly in shaping and creating their work, but also that they will inform future authoring and analytic tools.

2 Background

Locative literature, or location-based storytelling, has its routes in the digital tour guides created in the 1990s [5]. But over the last twenty years, alongside an improvement in location sensing and device capability, there has been a far broader range of applications. For example:

Tour Guides: There are a number of frameworks authors can use to publish tour guides, including HIPS which was used for the Louvre tour [5] and and REXplorer [2]. There are also location aware tour guides that use factual stories to paint a picture of a place [18].

Educational Tools: Educational tools focus on the process of learning about a place, and might therefore be considered a natural extension of a guide. Examples include interactive educational tools such as Gaius’ Day in Egnathia [10] and ‘edutainment’ systems such as Geist [13]. There are also location aware systems that use the same sculptural model as StoryPlaces, including the Ambient Wood project [21], and the Chawton House project [24, 23].

Location Aware Games: This category includes systems with game mechanics connected to player context as well as augmented reality experiences, such as Viking Ghost Hunt [19] or University of Death [7]. The work of [1] begins to describe two considerations when designing location aware games. Specifically, 1.5 Consider the social conventions of the place (e.g. not loud speaking in a church) and 1.7 Consider to include activities/events that are not part of the game, but happen in the real world.

Location Aware Fiction: focuses on delivering an engaging story within a place. There are many examples of locative fiction including The iLand of Madeira [8], San Servolo, travel into the memory of an island [20], and a collection of stories around Dublin [17].

It has been argued that these kinds of locative systems are better termed *Ambient Literature* as a challenge to the primacy of location, and in an effort to foreground a more human and less sensory dimension [9]. Others have looked at the problem from a more experiential perspective, for example modeling interaction as a trajectory that the user takes through complex spaces [3]. These perspectives do consider the wider context of locative interactions, but their complexity is also a barrier to their use by authors.

As a reaction to this complexity we have deliberately pared down the experience to focus on narrative and place, primarily working on the domain of

locative fiction, although our findings can be applied to the other categories. Our locative narratives are derived from a sculptural hypertext approach [4], which imagines the narrative as a collection of pages with constraints and behaviors (allowing location to be modeled as just another constraint).

There are many papers which provide recommendations for structuring hypertext narratives, which may be drawn upon when writing for place [6, 12]. Specifically, the work presented in [11] provides a practical approach to structuring a branching story, using four stages: paper, prototype, production, and testing. There are also approaches for character development from different perspectives [22]. But otherwise there is limited advice for authors. Most of the papers describing locative approaches focus on a single framework, without discussing overarching practices. In fact most papers which present digital locative narratives offer little practical advice on their creation.

3 Methodology

We have undertaken exploratory research using a novel framework of sequential story projects, developing our understanding at each stage and feeding it into the next [14]. The first two story projects were:

1. **Southampton Old Town** where we worked with forty creative writing students to write locative stories within the old city. We took a paper prototyping approach to keep the process open, so that we could understand the authoring process and develop authoring tools [10]. Five stories were chosen to be implemented for reader evaluation, and we also commissioned a professional writer to create a tent-pole story for a public launch.
2. **Bournemouth** where we worked with local authoring groups and colleges to create interactive locative stories based on the collections of the Bournemouth Natural Science Society. Five authors got to the point of having complete stories, and again we commissioned a professional author to create a more substantial story alongside them.

For both projects we hosted a public launch. If they were willing we recorded semi-structured interviews with readers afterwards to understand their experience. In total we recorded 25 interviews in Southampton, and 9 in Bournemouth.

Alongside these we also undertook the creation of our own locative story, taking advantage of a workshop and makespace on the Island of Tiree to create a longer experience called *The Isle of Brine* that could explore more complex and interactive structures [15]. We recorded and analyzed our experience as a co-operative inquiry, reflecting on the design decisions we made around narrative structure and location [16].

We then drew on these 13 stories, 34 interviews, and co-operative inquiry to establish a toolkit for authors in the form of twelve recommendations. We then used these in our third story project, based at Crystal Palace Park in London, once more commissioning a professional author to undertake a more substantial piece of work. As a form of validation we present that story, *Fallen Branches*

by Katie Lyons, and critically analyze it against the toolkit in order to see the impact of the recommendations.

4 The Toolkit

The toolkit we have created is a set of advice for location-authors, divided into Dealbreakers, Pragmatics, and Aesthetics. In each case we have described the entry in the toolkit, and provided an example of the evidence behind it.

4.1 Dealbreakers

The first three entries in the toolkit may appear to be self-evident, but we were surprised exactly how many of the authors and stories overlooked them. In our experience if the story did not adhere to these qualities then most readers would choose not to read, or would abandon the reading when this became clear.

Points of Arrival/Departure: Think about where readers will start and end your story (which may be in more than one place), and how well these match the normal ways that they arrive in or depart from a place. For example, think about starting near a standard point of entrance, and finishing near to the same place (as people often leave by the same route they arrive).

Participant: I guess we did makes some decisions about what routes to walk. But, I think that was mainly about, like, to do with where we want to finish, rather than what would be a good walk to do this story to.

Isle of Brine used three distinct areas of the island (one for each Act) made this especially important, as readers are likely to drive between areas, so each Act of the story starts and ends in a car park, with the assumption that the reader will explore the pages of the Act on foot before returning to their car.

Be Mindful of the Readers Effort to Move: Readers are more likely to choose a page that is nearer to them than one that is further away, and may ignore optional pages at a distance altogether. Avoid sending them on zig-zagging routes, or making them double-back too much.

Writers commonly underestimated how much effort it was for readers to move long distances, and how frustrating it was to be forced to retread their steps.

Participant: one location is quite near another location, but, actually, I can see how the toing and froing, for some people, wouldnt be what they wanted to do.

Participant: I feel like people would become tired and then would be, like, less inclined to be open to what you've got to say in the Act, by the end of it, anyway.

The Southampton story *The Destitute and the Alien* is a linear historical story. The writer wanted to locate scenes in appropriate locations, but many were along the old waterfront and the focus moved between them as logically required, without consideration of the spatial layout. In one case making the reader walk 500m to read 200 words, before being asked to walk back again.

Less criticism was directed at stories that used revisiting if they were mindful to maintain a continuous progression. For example the story *The Titanic Criminal in Southampton* was well received despite revisiting areas and this might be attributed to its looping structure as opposed to a more zig zagging path.

Consider Total Time to Read: Consider the total time it will take to experience the narrative, does it fit with the normal time constraints for people visiting that location. For example, one story could be designed to be read during a lunch break, or another story could be a more committed multi-hour experience.

Participant: I'd have probably chosen that one, but when we looked and it takes that long to do it - if we'd have come earlier in the day, maybe we would have...

In the Bournemouth story *Seeker of Secrets* the author created his story based on existing knowledge, using a virtual map to choose locations. He was later surprised to realize that it took four hours to read on location, which was inappropriate for most of the audience: tourists with around an hour to spare.

This is not a limit on absolute length, for example *Isle of Brine* takes a similar time, but is designed as a larger experience, more akin to an afternoon exploring the island. Furthermore it is broken into three sections, each at a separate location, and may be split into separate reading experiences over multiple days.

There are other solutions too. The Bournemouth story *The Pathways of Destiny* is a children's story focused on choice. Here the author created optional paths that allowed an early exit. By keeping required content to a minimum the author created an experience that the reader was able to control while still having a 'complete' story experience.

4.2 Pragmatic Considerations

Use Landscape to Control Navigation: For example, laying pages along paths so that they are typically read in a particular order, looking for loops in the landscape that could be used to help readers revisit pages, or placing key choices at junctions and crossroads.

Isle of Brine uses paths to create an illusion of choice, for example, in the first Act the story opens in the car park with a single path running the 200m to the beach, the path nodes do not have preconditions, meaning that they all appear in the reader at once as potential destinations, but in practice they will always be read in order, as the reader moves along the path to the beach.

In *The Pathways of Destiny* a question is posed in a plaza, which opens two potential answers to the north and south of the reader. Symbolically the northern

answer, in the direction of the town, leads to adventure, but the southern one, in the direction of the sea, leads to an early and less satisfying conclusion.

Identify and Use Bottlenecks in the Landscape: Bottlenecks such as gates, lone paths, or passes, are good places to put important narrative information, as most of your readers will pass through them and read any pages placed there.

In *Isle of Brine* there are key pages associated with the car parks, as the entrance and exit of each Act, key narrative information (for example, important background information on secondary characters) is deliberately placed in these pages to guarantee that all readers would encounter them.

Identify High Cost Locations: Certain locations are difficult to reach (they may be far away, up a steep hill or steps, or be otherwise inaccessible), these should only be used as optional pages, and might be considered as rewards.

Participant: I want a way to not just finish early but to say I cant get there but I still want to read the rest of the story or something

Participant: It was quite a long old walk up there to St Marys and back again... Its, like, I dont know. I mean, you cant change the geography of Southampton, obviously, but if there was maybe something else along the way

One story (not selected for publication) was for practical purposes unreadable; it followed the story of a shipping container, with non-optional pages in New York and Southampton - authors used to the flexible time and space of their storyworlds seem slow to adapt to the practicalities of locative literature.

Consider Accessibility and the Reader's Safety: On their walk will the reader be alone? Are the locations visible and well-populated? Are there access issues, e.g. for wheelchair users, or a family with a buggy? While using place to set the tone it is important that you do not put your readers at risk.

Participant: So, theres a bit of a risk ... you're looking about you, but youre also looking at your screen, and, you know, you feel you're slightly aware of [being] this person going around following a screen and not looking round about you

One Southampton story (not selected for publication) used time of day as a condition for some of its pages, requiring readers to visit isolated areas of the city in the middle of the night - effective for setting a mood, but not very practical.

4.3 Aesthetics

Narrative Areas: Consider how to use the landscape to create narrative areas. For example, stages of a journey, or areas with different themes or tones. It

will help readers if important transitions in your narrative match transitions in physical space (from one area to another).

For example, *Pathways of Destiny* uses the plaza at the foot of Bournemouth Pier as a setup area, where the reader meets the protagonists and makes choices about what role to take in the rest of the story, moving to the Lower Garden for the main quest where that role is assumed. While *Isle of Brine* uses three different areas of the island for its three Acts, each of which has a different tone.

Identify Points of Interest in the Landscape Consider how to use points of interest within your story. An important landmark demands attention within the narrative. These landmarks naturally draw readers to particular points. However, ignoring points of interest creates a disconnect between the story and the landscape - which may also be useful.

Points of interest can be overused, resulting something more like a guide.

Participant: The story we've done today was based on history and the one that we almost did and aborted partway through because the kids were bored was much more like a historical tour guide than a story.

So there is a need to balance the focus between the fictional and real worlds, this can be done by using points of interest for narrative effect rather than explaining them. For example, *Notes on an Illegible City*, an eclectic collection of poems and prose on Southampton's past, future and present, uses a key location outside an ancient church and in view of the medieval Bargate. However, the poem is about neither. Rather they are a fulcrum around which the poem can transport the reader into the past, the two acting as points of constancy that contrast with the shifting human life that is the poem's subject.

Consider the Theme/Tone of the Space Consider the theme and tone of the space and its relationship to the theme and tone of the narrative. The space may change over time, depending on time, season, year, or weather.

In one reading a key change in access could have damaged the experience but was saved by the atmosphere of the environment.

Participant: The church didn't work so well because it was locked so we couldn't get in and see the font. But then it was quite nice because they were playing doing some organ rehearsal, and it just, kind of, made an atmosphere ...

Use Diegetic References Carefully Diegetic references are mentions of the real world environment within the story. They can create a strong connection between the story and the place, but be mindful of how the landscape might change, and consider how the story would be affected.

In *The Pathways of Destiny* the author uses an area near a tethered balloon, where tourists could take rides, the story refers to the balloon explicitly.

But in the months between the story being written and published the balloon was removed for maintenance, creating confusion for readers at that point of the story. Diegetic references can be powerful, and circumstances such as the balloon above cannot really be planned for, but using them sparingly and avoiding more obvious problems (such as weather or seasonal changes) should limit the risk.

Participant: it made it almost a little more real ... You almost feel like a sort of special part of it. It was saying, it was here and it was this, and you might be sheltering under a bus stop, which is exactly what I was doing at the time.

Write to Hold Attention Write to hold the attention of the reader, both the device and events in the landscape are likely to be a distraction to your story. Therefore, it is important to consider ways in which you can hold attention (e.g. using style and pacing, or engaging subject matter), and/or write in such a way that less attention is required to be successful (e.g. using a poetic form, multimedia, or brevity - punchy installments of around 150 words are very effective).

Participant: ...theres just a lot of things going on round about you, other people walking around who are completely outside the story. So, its kind of an interesting experience for, yeah, both the things that link to the story, but also the things that are challenging you and distracting you.

Participant: I really liked the pictures. And, being there, having the pictures there, and then the building in front of you, I think that was really good. And, definitely added to the experience of reading.

5 Discussion and Example

From our experiences in StoryPlaces it is clear that the more effective locative stories work in tandem with their locations and landscapes.

Aesthetically our authors took advantage of the form to create new fictional layers on top of the real landscape, or reveal layers that have been lost to history. For example, drawing attention to appearance and disappearance, contrasting now/then and revealing connections between different perspectives of a place. Harmony between the narrative and the place will create a sense of connection in a reader and increase their feeling of presence. Discord will be jarring, and will draw attention to the dual nature of their experience, although that might be appropriate for some stories. On a practical level locative story authors have three ways of influencing their readers navigational paths through the story. They can use narrative logic (such as unlocking a node) to restrict reader choices, they can use the landscape to encourage readers to move through particular routes and visit nodes in a particular order, and they can use the writing itself to influence reader decisions using titles, hints and the content of pages to encourage readers to follow certain paths.

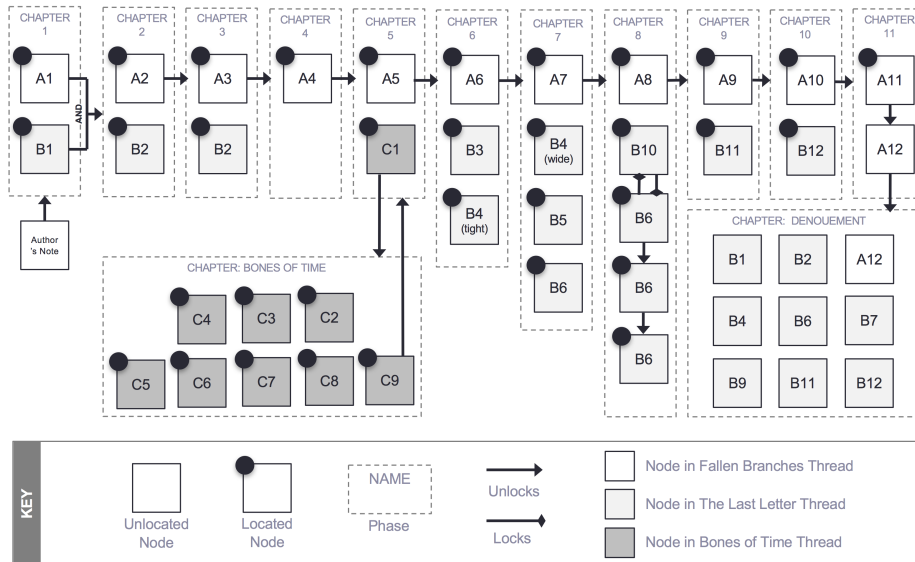


Fig. 1. The Sculptural Structure of Fallen Branches by Katie Lyons

In general, being more open (using writing or landscape to control reader movement through the story) will result in more interactive stories with the reader feeling greater agency and ownership of their experience.

On the other hand, an author writing a linear story will probably use narrative logic as the main way to control reader progress, but must make sure that this matches the way in which the landscape influences navigation. Many of the practical recommendations are concerned with aligning the requirements of the narrative and landscape. If they are at odds (linear pages that are scattered too far, or which require constant doubling back) it will be frustrating for the reader.

Figure 1 shows the sculptural structure of the Crystal Palace Park story authored by Katie Lyons for our third and final story project. During development Katie had access to our past story projects, as well as the toolkit.

Fallen Branches is constructed of three threads. The first, Fallen Branches (the A nodes), is a contemporary story, and describes a young women returning to Crystal Palace Park to fulfill the dying wishes of her Father. The second, The Last Letter (the B nodes), takes the form of a series of letters and letter fragments, and describes the story of two young lovers in the shadow of World War 1. The third, the Bone of Time (the C nodes), is an historical account of an incident in 1900 when an elephant killed its keeper and escaped from the palace.

Fallen Branches is the main thread that follows a circular route through the park. As the reader progresses, the nodes of the Last Letter appear and disappear in the landscape around them, these are optional and provide insight into the characters. At a certain point (Chapter 5) the reader can move away from the

main story into a separate garden to experience the Bones of Time. This is effectively an historical sub-story that provides background on the heirlooms, once completed it rejoins the main thread. Once Fallen Branches ends the key letters from the Last Letter become available with no location constraints, so that the reader can return to them later even if they leave the park.

In writing Fallen Branches Katie took key decisions in line with the toolkit.

Dealbreakers: Katie was mindful of the advice to consider points of arrival and departure (the story starts and ends at Crystal Palace Station), and also of the physical effort it takes readers to move, which is minimized by following a circular route around the park. Twice (node B4, and nodes B6/B10) Katie explicitly changes the structure to avoid double backs. In node B4 she makes the hotspot larger so that it can be activated from further away, and nodes B6/B10 lock one another, meaning that once the reader has made a choice, the other (which would then be out of their way) is no longer available. Making the Bones of Time an optional part of the story was also an effort to create a viable one hour story, as was the decision to open up all the key letters at the end with no location restrictions. This is explained in the author's note, and takes the pressure off the reader to collect every single node as they go.

Other Pragmatics: Although Fallen Branches is fairly tightly structured, Katie felt able to reduce the logical constraints in the Bones of Time sub-story, and allow the landscape (the path through the garden) to control navigation. Katie has also clearly identified some high cost locations at the top of the hill, and at the far end of the terrace, as these are only used for optional Last Letter nodes.

Aesthetics: The story uses a number of key points of interest (the sphinxes, grand central steps, and bust of the Palace's creator), but uses these as gathering points for reminiscence, rather than feeling the need to explain them. There is also use of narrative areas, as if the reader chooses to move from the contemporary nodes of Fallen Branches to the historical story in Bones of Time, this corresponds with the movement to a new area unused for any other part of the story. Katie's story also captures the themes of the park itself, which are of absence, loss, and past grandeur (the Crystal Palace burned down in 1936 and became derelict), while her story sets these in more human terms there is clearly an alignment between the theme of the place and the theme of the story.

6 Conclusions

In this paper we have described how we have used three locative story projects, part of StoryPlaces, to explore the poetics of locative literature. An area that despite growing popularity is very poorly understood. By engaging with over sixty authors in Southampton, Bournemouth, and London we have helped to develop and publish thirteen different locative stories, and conducted and analyzed 34 semi-structured interviews with their readers. We have also developed

our own locative story through a co-operative inquiry process on the island of Tiree, reflecting on the design and narrative decisions we had to make throughout the process. Based on these experiences and analyses we have developed a simple toolkit for locative authors in the shape of twelve recommendations. Three Dealbreakers, pragmatic considerations that must be observed to produce a readable story; four additional Pragmatic aspects, opportunities to use the landscape to control agency and solve interactive narrative problems; and five Aesthetic aspects, ways in which the landscape and narrative can work together to increase their impact on the reader.

We have used this toolkit in our third and final story project in Crystal Palace Park, and as a validation we have presented the story we commissioned as part of this project, *Fallen Branches*, and have explained how the author has followed the recommendations during the creation process.

Our work is the first significant attempt to capture the emerging craft of writing locative narratives, and to turn this into applicable design theory.

We are now exploring how the toolkit might inform the design of digital writing tools (for example, authoring tools that embed some of the recommendations, or analytical tools that look for some of the known problems). Our hope is that our work will refocus attention on the narrative potential of interactive locative storytelling, and lead to more sophisticated examples that use landscape and narrative together to manage agency, improve the reader experience, and reinforce the themes and emotional impact of the story.

References

1. Carmelo Ardito, Christos Sintoris, Dimitrios Raptis, Nikoleta Yiannoutsou, Nikolaos Avouris, and Maria Francesca Costabile. Design guidelines for location-based mobile games for learning. In *International Conference on Social Applications for Lifelong Learning*, pages 96–100, 2010.
2. Rafael Ballagas, André Kuntze, and Steffen Walz. Gaming tourism: Lessons from evaluating rexplore, a pervasive game for tourists. *Pervasive computing*, pages 244–261, 2008.
3. Steve Benford, Gabriella Giannachi, Boriana Koleva, and Tom Rodden. From Interaction to Trajectories: Designing Coherent Journeys Through User Experiences. In *Chi2009: Proceedings of the 27th Annual Chi Conference on Human Factors in Computing Systems, Vols 1-4*, pages 709–718, New York, New York, USA, 2009. ACM Press.
4. Mark Bernstein. Card shark and thespis: exotic tools for hypertext narrative. In *Proceedings of the 12th ACM conference on Hypertext and Hypermedia*, pages 41–50. ACM, 2001.
5. Jonathan Broadbent and Patrizia Marti. Location aware mobile interactive guides: Usability issues. In *ICHIM*, volume 97, pages 88–98, 1997.
6. Joanne Buckley. the play’s the thing: computer simulations and digital storytelling: A review of hamlet on the holodeck: The future of narrative in cyberspace: Murray, janet h.(1997). new york: The free press, 324 pp, 1998.
7. Ben S Bunting, Jacob Hughes, and Tim Hetland. The player as author: Exploring the effects of mobile gaming and the location-aware interface on storytelling. *Future Internet*, 4(1):142–160, 2012.

8. Mara Dionisio, Valentina Nisi, and Jos P Van Leeuwen. The iland of madeira location aware multimedia stories. In *Joint International Conference on Interactive Digital Storytelling*, pages 147–152. Springer, 2010.
9. Jonathan Dovey. Ambient literature: Writing probability. *Ubiquitous Computing, Complexity and Culture*, pages 141–154, 2016.
10. Charlie Hargood, Verity Hunt, Mark J Weal, and David E Millard. Patterns of sculptural hypertext in location based narratives. In *Proceedings of the 27th ACM Conference on Hypertext and Social Media*, pages 61–70. ACM, 2016.
11. Hartmut Koenitz. Design approaches for interactive digital narrative. In *International Conference on Interactive Digital Storytelling*, pages 50–57. Springer, 2015.
12. Hartmut Koenitz. Towards a specific theory of interactive digital narrative. *Interactive Digital Narrative*, pages 91–105, 2015.
13. Rainer Malaka, Kerstin Schneider, and Ursula Kretschmer. Stage-based augmented edutainment. In *International Symposium on Smart Graphics*, pages 54–65. Springer, 2004.
14. David Millard and Charlie Hargood. A research framework for engineering location-based poetics. In *Narrative and Hypertext Workshop, held in conjunction with ACM Hypertext 2016*, 2015.
15. David Millard and Charlie Hargood. Location location location: experiences of authoring an interactive location-based narrative. In *9th International Conference on Interactive Digital Storytelling (ICIDS 2016)*, August 2016.
16. David Millard and Charlie Hargood. Tíree tales: a co-operative inquiry into the poetics of location-based narratives. In *ACM Hypertext 2017*, July 2017.
17. Valentina Nisi, Ian Oakley, and Mads Haahr. Inner city locative media: design and experience of a location-aware mobile narrative for the dublin liberties neighborhood. In *Intelligent Agent*, volume 6, 2006.
18. Valentina Nisi, Ian Oakley, and Mads Haahr. Location-aware multimedia stories: turning spaces into places. *Universidade Católica Portuguesa*, pages 72–93, 2008.
19. Natasa Paterson, Gavin Kearney, Katsiaryna Naliuka, Tara Carrigy, Mads Haahr, and Fionnuala Conway. Viking ghost hunt: creating engaging sound design for location-aware applications. *International Journal of Arts and Technology*, 6(1):61–82, 2012.
20. Fabio Pittarello. Designing a context-aware architecture for emotionally engaging mobile storytelling. *Human-Computer Interaction-INTERACT 2011*, pages 144–151, 2011.
21. Yvonne Rogers, Sara Price, Geraldine Fitzpatrick, Rowanne Fleck, Eric Harris, Hilary Smith, Cliff Randell, Henk Muller, Claire O’Malley, Danae Stanton, et al. Ambient wood: designing new forms of digital augmentation for learning outdoors. In *Proceedings of the 2004 conference on Interaction design and children: building a community*, pages 3–10. ACM, 2004.
22. Carol Strohecker. A case study in interactive narrative design. In *Proceedings of the 2nd conference on Designing interactive systems: processes, practices, methods, and techniques*, pages 377–380. ACM, 1997.
23. Mark J Weal, Don Cruickshank, Danus T Michaelides, David E Millard, David C De Roure, Katherine Howland, and Geraldine Fitzpatrick. A card based metaphor for organising pervasive educational experiences. In *Pervasive Computing and Communications Workshops, 2007. PerCom Workshops’ 07. Fifth Annual IEEE International Conference on*, pages 165–170. IEEE, 2007.
24. Mark J Weal, Danus T Michaelides, David E Millard, David C De Roure, and Geraldine Fitzpatrick. Observations on pervasive information systems design. 2007.